

Shenzhen Huaxia Testing Technology Co., Ltd

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

Report Template Version: V03

Report Template Revision Date: Mar.1st, 2017

Telephone: +86-755-26648640 Fax: +86-755-26648637

Website: <u>www.cqa-cert.com</u>

FCC Test Report

Applicant: Shenzhen TAT Electronics Co., Ltd

Address of Applicant: F5-6, Building B, Hedong Industrial Park, Xixiang, Shenzhen, China

Manufacturer: Shenzhen TAT Electronics Co., Ltd

Address of F5-6, Building B, Hedong Industrial Park, Xixiang, Shenzhen, China

Manufacturer:

Factory: Shenzhen TAT Electronics Co., Ltd

Address of Factory: F5-6, Building B, Hedong Industrial Park, Xixiang, Shenzhen, China

Equipment Under Test (EUT):

Product: Remote Control

Model No.: T14, T12
Test Model No.: T14

Brand Name: N/A FCC ID: 2AM69T14

Standards: 47 CFR Part 1

 Standards:
 47 CFR Part 15, Subpart C

 Date of Test:
 2017-07-04 to 2017-07-11

Date of Issue: 2017-07-11

Report No.: CQASZ170701413EW-01

Test Result : PASS*

Tested By:

(Aaron Wa)

Reviewed By: Wen Mou

(Owen Zhou)

Approved By:

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^{*} In the configuration tested, the EUT complied with the standards specified above.



2 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ170701413EW-01	Rev.01	Initial report	2017-07-11



3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203	ANSI C63.10 (2013)	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 (2013)	N/A
Field Strength of the Fundamental Signal	47 CFR Part 15, Subpart C Section 15.249 (a)	ANSI C63.10 (2013)	PASS
Spurious Emissions	47 CFR Part 15, Subpart C Section 15.249 (a)/15.209	ANSI C63.10 (2013)	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.249(a)/15.205	ANSI C63.10 (2013)	PASS
20dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.215 (c)	ANSI C63.10 (2013)	PASS

N/A: Not Applicable, the EUT power supply by battery.



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5 General Information

5.1 Client Information

Applicant:	Shenzhen TAT Electronics Co., Ltd
Address of Applicant:	F5-6, Building B, Hedong Industrial Park, Xixiang, Shenzhen, China
Manufacturer:	Shenzhen TAT Electronics Co., Ltd
Address of Manufacturer:	F5-6, Building B, Hedong Industrial Park, Xixiang, Shenzhen, China
Factory:	Shenzhen TAT Electronics Co., Ltd
Address of Factory:	F5-6, Building B, Hedong Industrial Park, Xixiang, Shenzhen, China

5.2 General Description of EUT

Name:	Remote Control
Model No.:	T14, T12
Trade Mark :	N/A
Hardware Version:	V1.0
Software Version:	V10
Frequency Range:	2405 MHz ~ 2475MHz
Modulation Type:	GFSK
Number of Channels:	3 (declared by the client)
Sample Type:	Portable production
Test Software of EUT:	N/A
Antenna Type:	PCB antenna
Antenna Gain:	1.5dBi
Power Supply:	Lithium battery: CR2032, DC3V

Note: Only the model T14 was tested, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, with difference being color of appearance and model name.



Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2405MHz	2	2433MHz	3	2475MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel(CH1)	2405MHz
The Middle channel(CH2)	2433MHz
The Highest channel(CH3)	2475MHz



5.3 Test Environment and Mode

Operating Environment:	Operating Environment:				
Temperature:	24.0 °C				
Humidity:	52 % RH				
Atmospheric Pressure:	1008 mbar				
Test Mode:	Set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.				

5.4 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark	FCC certification
/	/	/	/	/

5.5 Test Location

All tests were performed at:

Shenzhen Tongce Testing Lab,

1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China

5.6 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the **Shenzhen Tongce Testing Lab** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for TCT laboratory is reported:

Test	Range	Uncertainty	Notes
Radiated Emission	Below 1GHz	±3.92dB	(1)
Radiated Emission	Above 1GHz	±4.28dB	(1)
Conducted Disturbance	0.15~30MHz	±2.56dB	(1)

⁽¹⁾ This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



5.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC - Registration No.: 572331

Shenzhen Tongce Testing Lab has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 572331

5.8 Deviation from Standards

None.

5.9 Abnormalities from Standard Conditions

None.

5.10 Other Information Requested by the Customer

None.



5.11 Equipment List

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Due Date
1	EMI Test Receiver	R&S	ESVD	100008	2017/08/11
2	Spectrum Analyzer	R&S	FSEM	848597/001	2017/08/11
3	Spectrum Analyzer	Agilent	N9020A	MY49100060	2017/08/12
		EM Electronics			
		Corporation			
4	Pre-amplifier	CO.,LTD	EM30265	07032613	2017/08/11
5	Pre-amplifier	HP	8447D	2727A05017	2017/08/11
6	Loop antenna	ZHINAN	ZN30900A	12024	2017/08/13
7	Broadband Antenna	R&S	VULB9163	340	2017/08/13
8	Horn Antenna	R&S	BBHA 9120D	631	2017/08/13
9	Horn Antenna	R&S	BBHA 9170	373	2017/08/13
10	Antenna Mast	ccs	CC-A-4M	N/A	N/A
	Coax cable				
11	(9KHz~40GHz)	тст	RE-low-01	N/A	2017/08/11
	Coax cable				
12	(9KHz~40GHz)	тст	RE-high-02	N/A	2017/08/11
	Coax cable				
13	(9KHz~40GHz)	тст	RE-low-02	N/A	2017/08/11
	Coax cable				
14	(9KHz~40GHz)	тст	RE-high-04	N/A	2017/08/11
15	Spectrum Analyzer	R&S	FSU	200054	2017/08/11
16	Antenna Connector	тст	RFC-01	N/A	2017/08/12
17	RF cable(9KHz~40GHz)	TCT	RE-06	N/A	2017/08/12

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.



6 Test results and Measurement Data

6.1 Antenna Requirement

Standard requirement: 47 CFR Part 15C Section 15.203

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:



The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 1.5dBi.



6.2 Radiated Emission

Test Requirement:	47 CFR Part 15C Section	n 15.249 and 15.20	09 and 15.20	05			
Test Method:	ANSI C63.10: 2013						
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)						
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark	7	
	0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak	1	
	0.009MHz-0.090MHz	Average	10kHz	30KHz	Average	1	
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak	1	
	0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak	1	
	0.110MHz-0.490MHz	Average	10kHz	30KHz	Average		
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak		
	30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak		
	Above 1GHz	Peak	1MHz	3MHz	Peak		
	Above 1912	Peak	1MHz	10Hz	Average		
	Note: For fundamental value, RMS detection	frequency, RBW=5 tor is for Average v		=5MHz, Peak	detector is fo	r PK	
Limit: (Spurious Emissions and band edge)	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m) Remark	Measurem distance (
<i>3</i> ,	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300		
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30		
	1.705MHz-30MHz	30	-	-	30		
	30MHz-88MHz	100	40.	0 Quasi-pea	k 3		
	88MHz-216MHz	150	43.	5 Quasi-pea	k 3		
	216MHz-960MHz	200	46.	0 Quasi-pea	k 3		
	960MHz-1GHz	500	54.	0 Quasi-pea	k 3		
	Above 1GHz	500	54.	0 Average	3		
	Note: 1) 15.35(b), Unless otherwise specified, the limit on peak radio freque emissions is 20dB above the maximum permitted average emission I applicable to the equipment under test. This peak limit applies to the total permission level radiated by the device.						
	2) Emissions rac	diated outside of the	e specified f	requency band	s, except for		
	harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209,						
	whichever is the	lesser attenuation.	1				
Limit:	Frequency	Limit (dBuV/	/m @3m)	Remark			
(Field strength of the	2400MHz-2483.5MH	94.0)	Average Val	ue		
fundamental signal)	114.0 Peak Value						



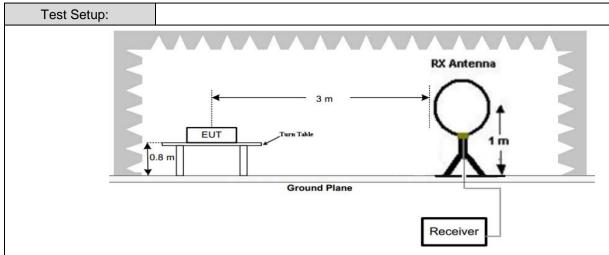
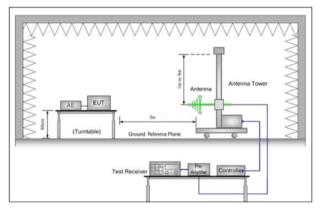


Figure 1. Below 30MHz



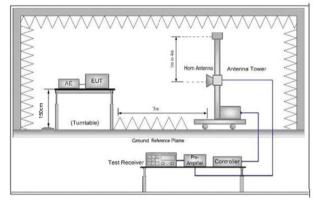


Figure 2. 30MHz to 1GHz

Figure 3. Above 1 GHz

Test Procedure:

- a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
 - 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

Note: For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.



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	e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
	 f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. g. Test the EUT in the lowest channel,the middle channel,the Highest channel h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case. i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting mode
Final Test Mode:	Pretest the EUT at Transmitting mode, found the Transmitting mode which it is worse case
	Pretest the EUT at Transmitting mode, For below 1GHz part, through pre-scan, the worst case is the highest channel.
	Only the worst case is recorded in the report.
Test Voltage:	DC3.0V
Test Results:	Pass

Measurement Data

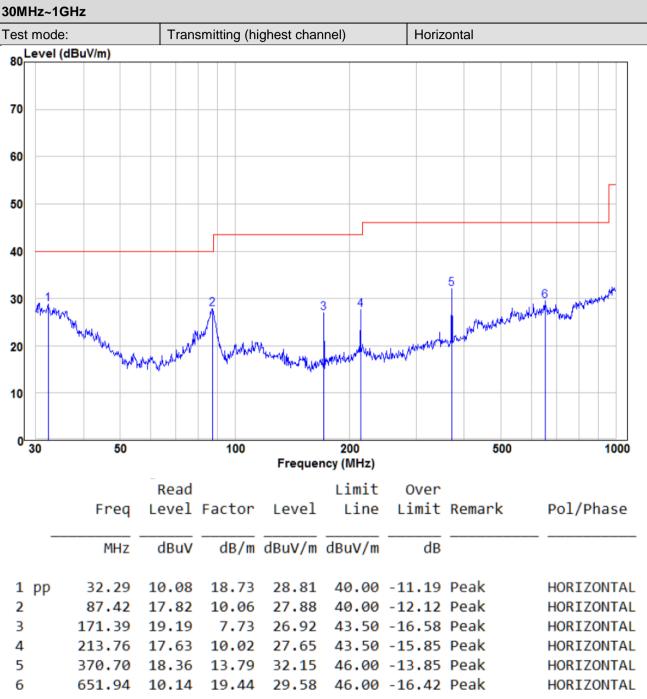
1) Field strength of the fundamental signal

Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
2405.00	85.82	-9.4	76.42	114	-37.58	Peak	Н
2405.00	82.64	-9.4	73.24	94	-20.76	Average	Н
2405.00	97.63	-9.4	88.23	114	-25.77	Peak	V
2405.00	94.79	-9.4	85.39	94	-8.61	Average	V
2433.00	84.73	-9.34	75.39	114	-38.61	Peak	Н
2433.00	81.17	-9.34	71.83	94	-22.17	Average	Н
2433.00	98.5	-9.34	89.16	114	-24.84	Peak	V
2433.00	96.26	-9.34	86.92	94	-7.08	Average	V
2475.00	86.6	-9.32	77.28	114	-36.72	Peak	Н
2475.00	84.62	-9.32	75.3	94	-18.7	Average	Н
2475.00	100.71	-9.4	91.31	114	-22.69	Peak	V
2475.00	97.24	-9.4	87.84	94	-6.16	Average	V

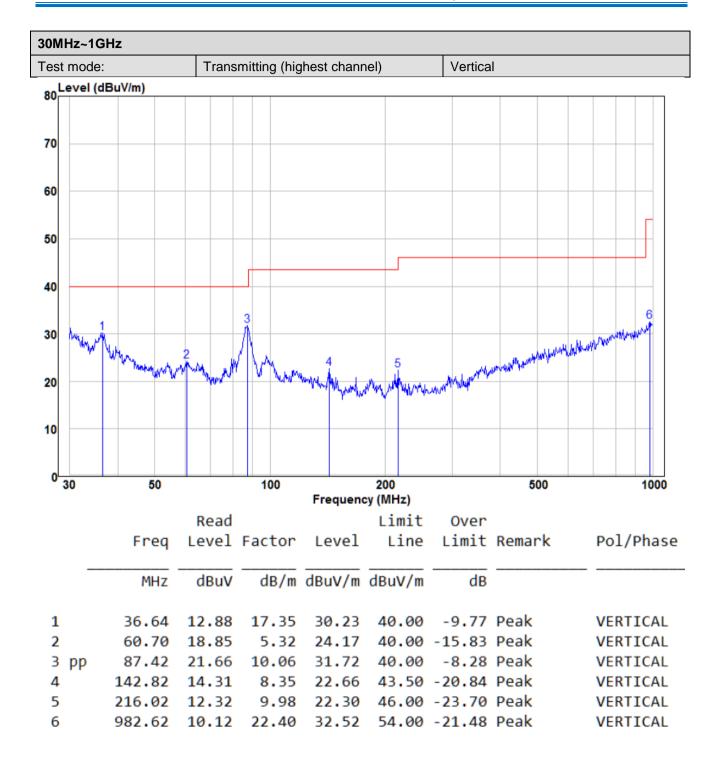
- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
 - Final Test Level =Receiver Reading + Antenna Factor + Cable Factor Preamplifier Factor



2) Spurious Emissions









Above 1GHz			
Test mode:	Transmitting	Test channel:	Lowest

Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
1276	51.87	-13.77	38.1	74	-35.9	Peak	Н
1696	49.96	-8.66	41.3	74	-32.7	Peak	Н
1864	48.75	-7.09	41.66	74	-32.34	Peak	Н
3178	49.83	-7.2	42.63	74	-31.37	Peak	Н
4810	51.54	-4.32	47.22	74	-26.78	Peak	Н
6874	47.84	-0.03	47.81	74	-26.19	Peak	Н
1276	51.3	-13.77	37.53	74	-36.47	Peak	V
1810	48.7	-6.93	41.77	74	-32.23	Peak	V
3442	49.55	-6.66	42.89	74	-31.11	Peak	V
3910	50.23	-4.97	45.26	74	-28.74	Peak	V
4810	56.08	-4.32	51.76	74	-22.24	Peak	V
6040	47.79	-2.00	45.79	74	-28.21	Peak	V

- The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
 Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, The disturbance above 7GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.



Above 1GHz			
Test mode:	Transmitting	Test channel:	Middle

Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
1264	53.71	-13.86	39.85	74	-34.15	Peak	Н
1732	48.9	-7.68	41.22	74	-32.78	Peak	Н
1828	49.26	-6.97	42.29	74	-31.71	Peak	Н
3346	49.74	-6.97	42.77	74	-31.23	Peak	Н
4864	51.52	-4.13	47.39	74	-26.61	Peak	Н
6874	47.45	-0.03	47.42	74	-26.58	Peak	Н
1264	58.41	-13.86	44.55	74	-29.45	Peak	V
1732	48.97	-7.68	41.29	74	-32.71	Peak	V
3730	49.68	-5.16	44.52	74	-29.48	Peak	V
4210	49.27	-5.01	44.26	74	-29.74	Peak	V
4864	52.34	-4.13	48.21	74	-25.79	Peak	V
6868	48.15	-0.06	48.09	74	-25.91	Peak	V

- The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
 Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, The disturbance above 7GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.



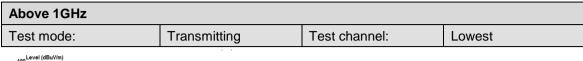
Above 1GHz			
Test mode:	Transmitting	Test channel:	Highest

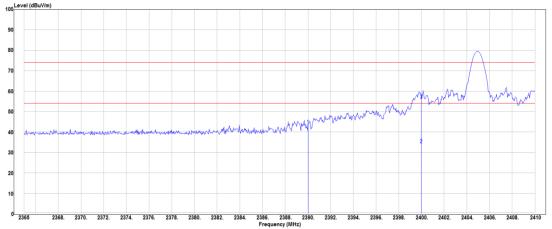
Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
1264	56.31	-13.86	42.45	74	-31.55	Peak	Н
1690	52.43	-8.93	43.5	74	-30.5	Peak	Н
3808	49	-4.93	44.07	74	-29.93	Peak	Н
4954	50.41	-4.03	46.38	74	-27.62	Peak	Н
5878	48.08	-2.21	45.87	74	-28.13	Peak	Н
6880	47.54	-0.01	47.53	74	-26.47	Peak	Н
1264	54.2	-13.86	40.34	74	-33.66	Peak	V
1696	50.21	-8.66	41.55	74	-32.45	Peak	٧
1828	48.59	-6.97	41.62	74	-32.38	Peak	V
4072	49.52	-5.09	44.43	74	-29.57	Peak	V
4948	52.65	-4.03	48.62	74	-25.38	Peak	V
6880	47.52	-0.01	47.51	74	-26.49	Peak	V

- The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
 Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, The disturbance above 7GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

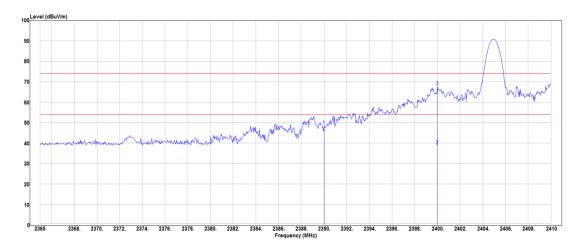


3) Band edge





Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
2390	47.76	-4.36	43.4	74	-30.6	Peak	Н
2400	60.07	-4.36	55.71	74	-18.29	Peak	Η
2400	38.22	-4.36	33.86	54	-20.14	Average	Н

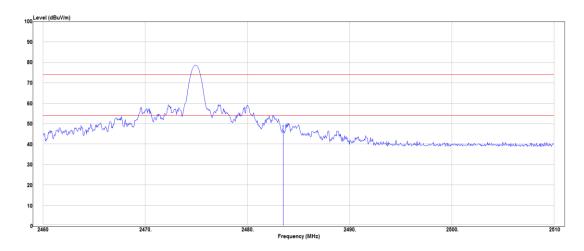


Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
2390	52.90	-4.36	48.54	74	-25.46	Peak	V
2400	71.93	-4.36	67.57	74	-6.43	Peak	V
2400	43.17	-4.36	38.81	54	-15.19	Average	V

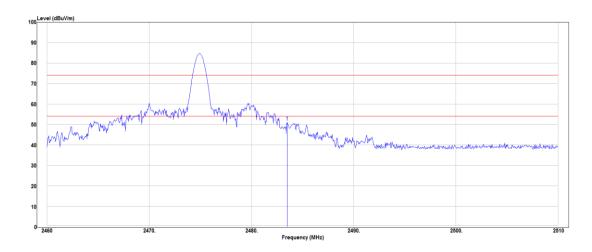


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Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
2483.5	51.01	-4.22	46.79	74	-27.21	Peak	Н

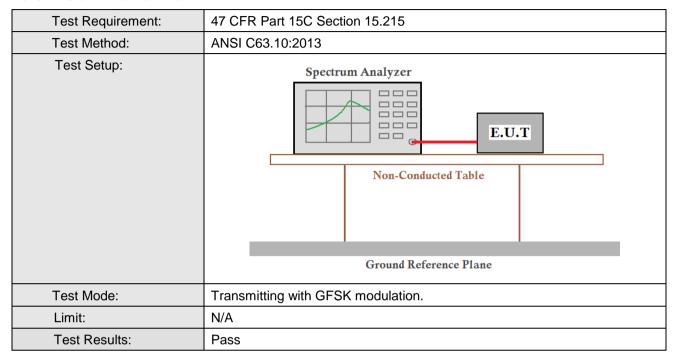


Freq (MHz)	Read_Level (dBµV)	Factor (dB)	Level (dBµV/m)	Limit_Line (dBµV/m)	Over_Limit (dB)	Remark	Pol.
2483.5	55.53	-4.22	51.31	74	-22.69	Peak	V

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
 - Final Test Level = Receiver Reading + Antenna Factor + Cable Factor Preamplifier Factor
- 2) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.



6.3 20dB Bandwidth

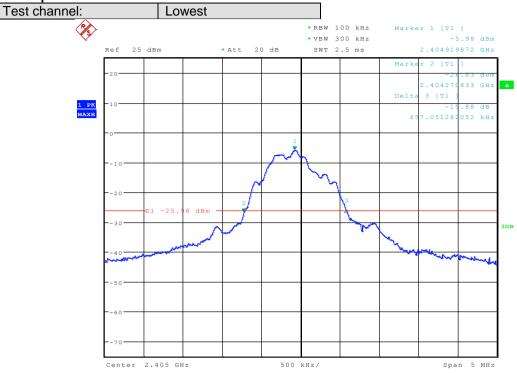


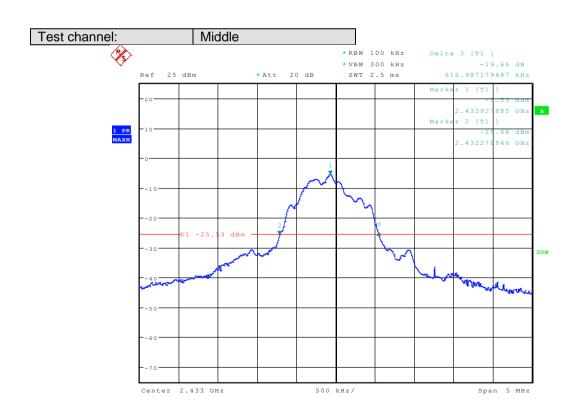
Measurement Data

Test channel	20dB bandwidth (MHz)	Results
Lowest	0.657	Pass
Middle	0.617	Pass
Highest	0.657	Pass

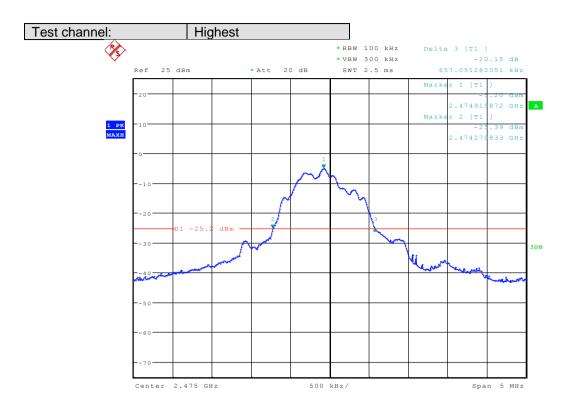














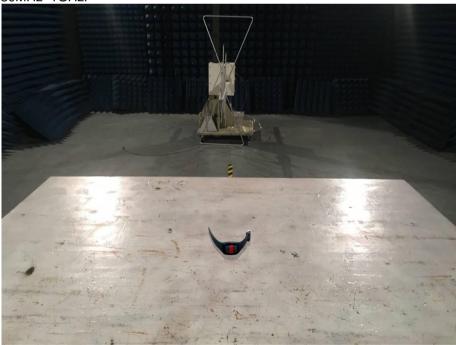
7 Photographs

7.1 Radiated Emission Test Setup

9kHz~30MHz:



30MHz~1GHz:











7.2 EUT Constructional Details









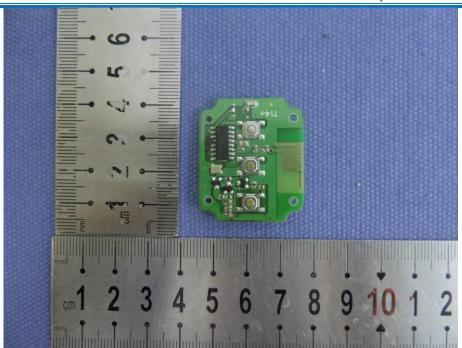


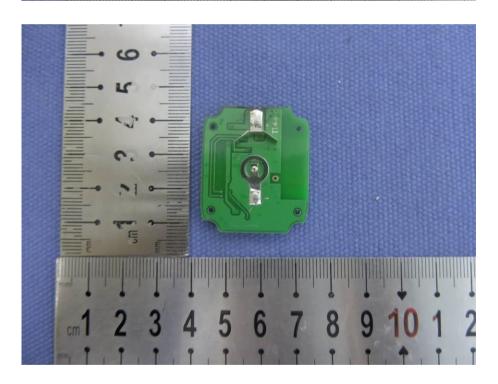




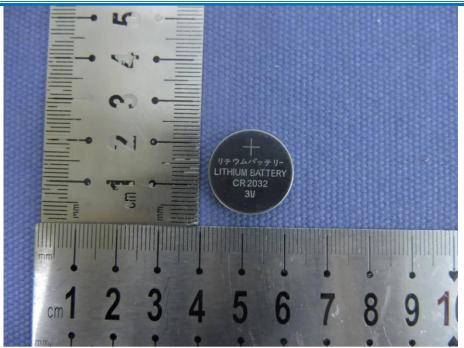












END OF THE REPORT